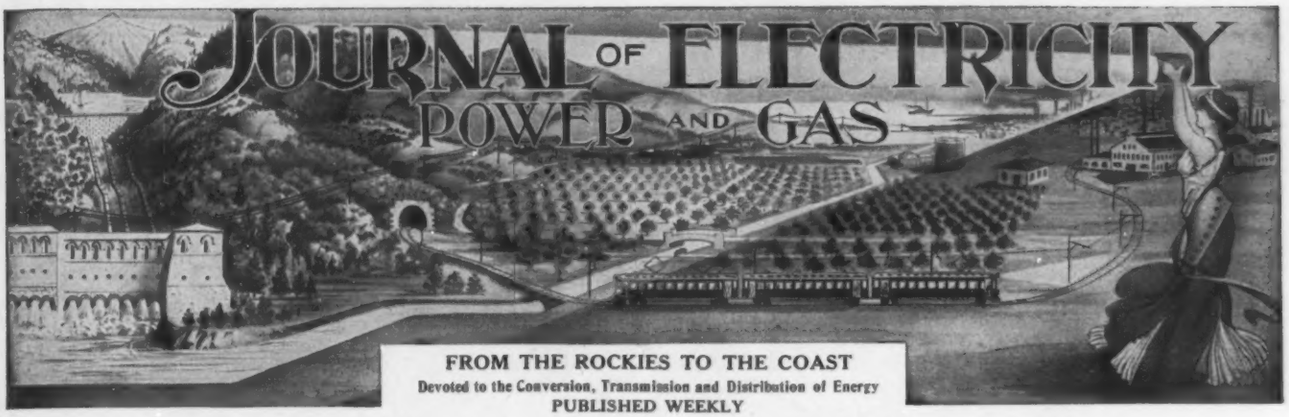
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Devoted to the Conversion, Transmission and Distribution of Energy
PUBLISHED WEEKLY

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THE

Journal of Electricity, Power and Gas

Devoted to the Conversion, Transmission and Distribution of Energy.

VOLUME XXI. SAN FRANCISCO, CAL., SEPTEMBER 26, 1908 No. 13

PENSTOCK DESIGN FOR WATER-POWER PLANTS.

By J. W. WHITE.

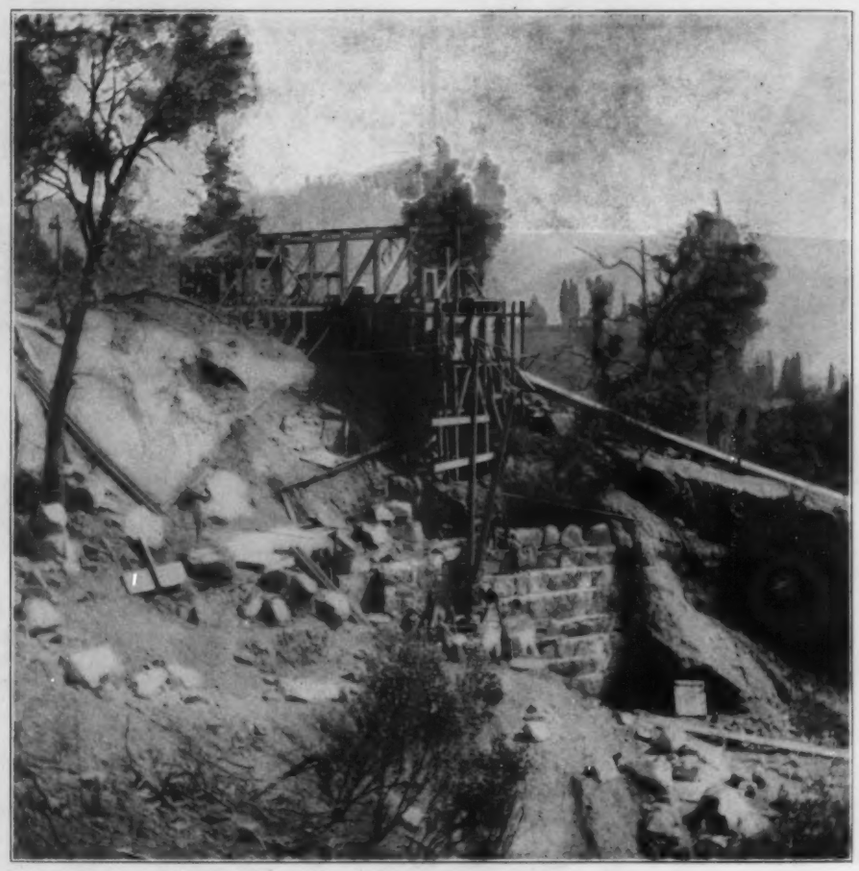
The old adage, "A stitch in time saves nine," is a most pertinent one and is only succeeded by one other, "An ounce of prevention is worth a pound of cure." The following article is conclusive proof of them both, as regards the proper construction of penstocks for hydro-electric power developments.

The writer was at one time superintendent of the plant described below, which then had an output of 3000 kilowatts, taking water from the dam through a flume and ditch to the penstock in question, which was situated above the power house at the brow of the hill where two rivers met.

The static head of the plant was 580 feet. The flume and ditch together were about seven miles long, and there being no storage reservoir it was necessary to bring down sufficient water for the peak load and spill the extra water either at penstock or at points along the flume.

Both methods were used.

At peak load the water consumption is about 5700 cubic feet per minute.



Penstock During Construction.

When the plant was first installed a small waste gate was provided and a short length of flume boxing was run out at end of waste gate (d) on plan and shown by dotted lines D.

It was soon found that this would not take care of fluctuating loads and that it was rapidly cutting away the foundation of the penstock.

Before it was changed, however, a deep cut was washed out, thus removing the toe of the embankment, and the next winter the rains caused the banks on either side to slip into the cut.

To remedy this, the penstock was extended at right angles as shown by dotted lines (E) in plan and a spillway 60 feet longer added, the water discharging at the end of (E) into cut at the right. This, in turn, went out piece by piece as the water cut back and undermined the footing.

The damage had been done by this time, however, and the next winter the rains caused the footing of the bent posts for the addition to penstock and flume to slip, and bank caving in carried off the flume, and so a steep incline (E2) was built to carry the water directly into the cut, discharging onto bedrock which had been laid bare by this time and was some 40 feet below the original surface. While this stopped the washing, the rains still carried the banks away, taking out the footings of the spillway.

Such was the condition when the writer entered the company's employ in January.

The winter rains made it necessary to have men working on the banks and footings, till spring, when, as soon as the rains stopped, excavation was begun to build a retaining wall (J) to hold the bank upon which the penstock rested, as shown in sketch (1). Upon cutting down the disintegrated granite, it was found that there was a layer of country rock underlying the above granite, and the soil drainage following this seam was causing the one to slip on the other, therefore it was necessary to cut into the country rock so as to get a good footing for the toe of the wall. The wall was built of block granite, quarried by drifting, and the back of the wall was rubble filled.

The total height of wall was 36 feet, and base 14 feet.

As to the spillway, the writer decided to use steel pipe on account of its durability, lightness and ease in laying, also low cost.

It was necessary to make the sizes of the pipe according to the conditional requirements.

The static head between the water in the spillway and where it was desired to discharge the water was 97 feet, and as it was expensive to trestle the pipe it was decided to hang it from the bottom of the spillway by adjustable rods and support it along the face of the wall, as shown in the sketch.

The vertical height was about 48 feet to the center of the bend, and from there we wished to carry it at a constant grade to a point 150 feet further down the cut to where bedrock outcropped.

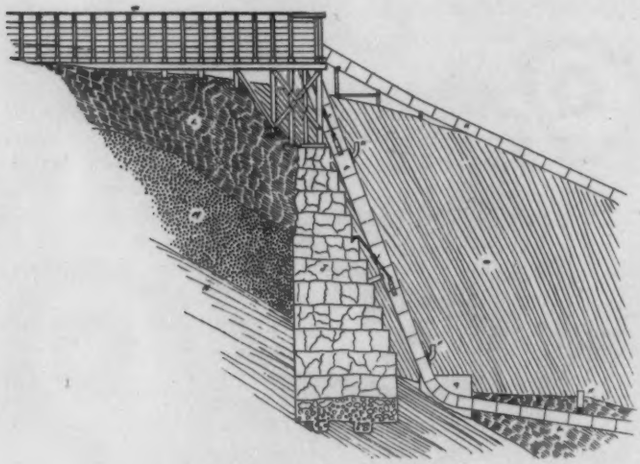


Fig. 1. Side Elevation of Penstock and Retaining Wall.

As the head in the spillway was about 3 feet 6 inches, the upper end was enlarged to 3 feet 6 inches to give a safe and submerged head.

$$\text{Submerged head} = \frac{V^2}{2G} = .0155V^2.$$

Where total amount of water = 5700 feet per minute.

V = 13.45 feet per second.

$.01551^2$ = 2 feet 8 inches.

The theoretical velocity of the water at the bend under 48-foot head = 55.5 feet, or a stream diameter of 17¼ inches. On account of friction below it was necessary to taper the pipe to 20 inches diameter at the curve and the remainder of the line was constructed of this size, the entire line being 14 gauge. Therefore we had the following:

Velocity head of discharge 5700 feet per minute through 20-inch pipe at 43.5 feet per second velocity = 29.3 ft.

Friction head of 150 feet of 20-inch pipe at a velocity of 43.5 feet per second = 52.0 ft.

Friction head of bend ..... 4.2 ft.

Friction head of tapering pipe to bend ..... 4.0 ft.

Total ..... 89.5 ft.

Actual head obtainable, 96 feet.

This gave a safe margin for variations, and when line was tested the line delivered the amount required with a submerged head at intake of 2 feet 11 inches.

On account of increasing the tapering size of the line to 20 inches instead of 17¼ at the bend, it was necessary to put in two air vents in the line to relieve the vacuum (see H).

Two relief valves were also placed on the 20-inch line to help relieve it when running at partial loads when the vacuum was greatest.

Great care was taken to thoroughly anchor the entire line and at the bend and discharge it is anchored in concrete.

As it was necessary to operate the plant while this was building and to make all changes and excavations with the penstock full of water, great care was exercised to prevent accidents.

An auxiliary pipe line was run along the bank of 22-inch 16-gauge pipe to carry off the water while the new spillway was building. This was of old second-hand pipe and it emptied the water into the cut where the new one discharged and was left in place on completion of the new one.

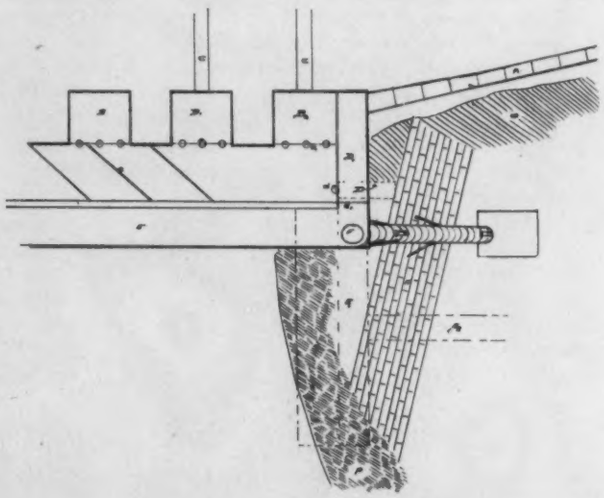


Fig. 2. Plan of Penstock, Old and New.

Since the above was installed two years ago, nothing has been expended upon this part of the system, and the extra cost was but $5,500, where the cost and maintenance of the original was over $6,000 for the previous three years.

LECTURES BY C. L. DE MURALT.

Mr. C. L. de Muralt, owing to the success which attended his lectures during the past academic year, has been reappointed professor of electric engineering at the University of Michigan for the coming year. During the winter semester, Professor Muralt will devote his attention to the consideration of the more general aspects of applied electricity. The course of lectures will include the discussion of (1) the characteristics and application of alternating and continuous current motors; (2) the design, construction, and operation of electric plants; (3) the principles and methods of transmitting, distributing, and controlling alternating currents; (4) the calculation and operation of electric railways; and (5) the management of electric properties, with special references to the commercial aspects of electrical engineering.

PROCEEDINGS
SIXTEENTH ANNUAL CONVENTION
PACIFIC COAST GAS
ASSOCIATION.

(Continued.)

THE HIGH PRESSURE SYSTEM OF THE LOS ANGELES GAS AND ELECTRIC CO.

By C. A. Luckenbach.

In 1901 the Los Angeles Lighting Company, the predecessor of the Los Angeles Gas and Electric Company, commenced the installation of a high pressure system, which it was intended should be used both for feeding the then existing low pressure system and also as a direct high pressure distributing system. At that time the phenomenal growth of Los Angeles had but fairly commenced, and it was hardly dreamed that in a few short years the inhabited territory would almost double and the outlying districts build up to such an extent as to demand the large additions which have since become necessary.

At that time two high pressure lines were installed, each with its own compressor located at different points in the city. The one was installed for the double purpose of acting as a feeder for the low pressure system and also for direct distribution and was supplied through a duplex, single stage, belt-driven compressor having a piston displacement of 50,000 cubic feet per hour, and capable of working against a pressure of sixty pounds. The other was installed for the purpose of feeding the pressure in the East Los Angeles district only and was supplied through a straight line, belt-driven compressor having a piston displacement of 19,260 cubic feet per hour, and capable of working against a pressure of sixty pounds.

The unprecedented increase in building and the rapid extension of the residence territory demanded material extensions in the system, and in 1903—less than a year and a half after the first installation—it was decided to erect a compressor station, install larger apparatus, and handle all of the compressed gas from one point. This was completed and put in operation in the fall of 1903. At that time the system consisted of 21⅓ miles of pipe, of which twelve miles were 6-inch main line and 15⅓ miles 2-inch laterals, all inside the city of Los Angeles.

Up to that time the primary object in view was the using of the compressed gas for feeding the pressures of the low-pressure system, and at that date the direct high-pressure distributing system may really be said to have commenced. Twelve miles of 2-inch mains which had heretofore been low-pressure mains, were made high-pressure lines; extensions were rapidly made beyond the city of Los Angeles, and the system extended to South Pasadena, Alhambra, and Dolgeville, and a 6-inch service extension of 4800 feet, for the purpose of furnishing gas to the Pasadena Consolidated Gas Company, was run.

In 1905 the construction of a third line for the purpose of supplying the northwest portion of Los Angeles city, East Hollywood, and Hollywood city was completed, and in 1907 the feeder lines of East Los Angeles were connected with the high-pressure system, the four lines, on August 1, 1908, comprising 128 miles of feeders and laterals under high pressure.

Compressor Station.

Location.—The compressor station is located approximately 1000 feet from the generating plant of the company and within a few feet of two 1,000,000 cubic feet storage holders.

Buildings.—The boiler room is a brick, steel and galvanized iron, fireproof building 42 feet by 38 feet by 32 feet high, and so arranged that housing for an additional boiler can be provided without interfering with the present structure.

The main compressor room is a brick, steel and galvanized iron, fireproof building 28 feet 6 inches wide by 82 feet long by 19 feet high, and so constructed that a duplicate of the present large compressor may be installed and the proper housing provided without interfering with or requiring any change in the present structure.

The building for the auxiliary compressors is 50 by 125 feet by 19 feet high, built of frame and galvanized iron.

The two compressor buildings are connected by a covered steel and galvanized iron passageway, providing ready communication and allowing the operators in either building full and unobstructed view of the interior of the other.

Boilers.—Steam is furnished from two 500 horsepower (builder's rating) Stirling water tube boilers, each having 2020 square feet of heating surface and 98.85 square feet of grate surface, and built for a working pressure of 150 pounds. Each boiler has its individual stack 60 inches in diameter and 100 feet in height above the floor level. The boilers are equipped for burning either oil or carbon and are installed with the idea of adding an additional boiler when the service requires it.

Compressors.—Four compressors have been installed, having a total capacity of 908,000 cubic feet per hour, all built for operating against a pressure of 60 pounds. The machines in the order of their importance are:

One 24 and 42x34x60 Corliss Cross Compound Duplex Compressor with Cincinnati valve gear on compressor end, having four inlet valves on each compressor cylinder and spherical seated bearings on crank shaft. The steam and gas cylinders are arranged tandem, the steam cylinders being next to the frame. The machine is provided with an automatic governor controlling speed and pressure by action upon the cut-off. The opening and closing of the suction and closing of the discharge are controlled by means of valves mechanically operated from eccentric on the main crank shaft, and the discharge opening is controlled by steel poppet valves, working on bronze seats. The frame is of the heavy rolling mill type, the main pillow block being cast as part of the bed. The slides are of the bored type and heavily ribbed. The flywheel is eighteen feet in diameter and the total weight of the machine is 300,000 pounds. The diameters of the openings are as follows: Steam pipe, 8 inches; exhaust pipe, 14 inches; gas suction, 16 inches, and gas discharge, 14 inches. The capacity is 553,000 cubic feet per hour.

One Belt-driven Horizontal Duplex Compressor having 25 inch by 24 inch cylinders. The machine weighs 48,000 pounds and has a capacity of 150,000 cubic feet per hour. The motive power of this machine is a 350-horsepower, 500-volt, compound-wound, direct-current motor.

One Belt-driven Horizontal Duplex Compressor having 22 inch by 30 inch cylinders. The machine weighs 46,700 pounds and has a capacity of 148,000 cubic feet per hour. The motive power of this machine is a 350-horsepower, 500-volt, compound-wound, direct-current motor.

One Belt-driven Horizontal Duplex Compressor having 16 inch by 18 inch cylinders. The machine weighs 13,600 pounds and has a capacity of 57,000 cubic feet per hour. The motive power is a 125-horsepower, tandem compound engine.

The three latter machines are provided with positive moved suction valves of the Corliss type and discharge valves of the regular poppet type, automatic in action.

Pumps.—Feed water is supplied by duplicate 10x6x10 duplex brass-lined pumps, and oil by duplicate 6x4x6 duplex brass-lined pumps, while boiler compound is supplied by a 3x2x4 duplex pump.

Fuel Supply.—Two fuel oil tanks, each of 280 barrels capacity, are connected with the main storage tank at the generating plant and are so arranged that they are filled by gravity, or, in case of necessity, by pumping, while the oil is heated by exhaust steam in a heater 42 inches in diameter by 16 feet long.

Water Supply.—Feed water is supplied from the city mains, and a water tank 6 feet in diameter by 15 feet high is connected for an emergency, the water being heated by exhaust steam in a heater 5 feet in diameter by 15 feet 6 inches long.

Piping.—All steam piping is of extra heavy pipe with the best of fittings.

Gas piping is of wrought iron and steel riveted pipe with long sweep fittings, and all piping below the floor level is in trenches covered with iron plates so that any portion is accessible at a moment's notice.

Suction is obtained through two 16-inch steel riveted pipes from two 3-lift gas holders, each 125 feet 6 inches in diameter and 123 feet high, and each containing when full 1,016,820 cubic feet of gas, and having a pressure on the third lift of eleven inches. These suctions are so arranged that gas may be taken from either or both holders at the same time and so that the main and auxiliary plants may draw from either holder independently at the same time.

On the discharge between the compressors and the distributing board a compression tank 5 feet in diameter by 11 feet 3 inches in length is located for taking care of any sudden fall in pressure.

The discharge from all the compressors leads to a common point or distributing board at the inlet of the feeder mains, where by valves the requisite amount of gas to maintain the necessary pressure in the respective lines is released. The auxiliary compressors are also connected so that any one of them can discharge into any one of the feeder lines while the others are discharging into the main header.

Distributing System.

With the exception of a comparatively small portion, all of the mains and laterals of the system are genuine wrought iron screw pipe. For a distance of approximately a mile from the compressor station lead expansion joints are placed at approximately every 500 feet and similar joints are placed at each end of all bridges and trestles carrying pipe. At the offtake of each lateral a gate valve or stop-cock is placed, as well as at each end of all bridges and trestles crossed by the mains. Wherever a service is taken off, a pipe clamp with lead gasket is used, and stop-cocks are placed in the service just after leaving the main and just before reaching the meter. Each service has its individual regulator set for four inches outlet pressure and all meters are iron. All pipe is painted with water gas tar, the tar being applied to the steam-heated pipe with a brush.

Four separate and distinct feeders convey gas to the respective districts and to the feeders of the low-pressure districts as follows:

Line No. 1 to high-pressure district No. 1 and low-pressure feeders of the southwestern portion of the city.

This district lying at the southeast corner of the city of Los Angeles is 3.2 miles long and 1.8 miles wide, with an approximate area of 5¼ square miles, and the nearest point is 2½ miles from the compressor station. The main feeder line, slightly over five miles long, is made up of 12, 10 and 6-inch pipe. At the end of the 12-inch section a connection is made with the 30-inch inlet of the main storage holder of the company, the holder being filled from this line. It may be of interest, at this point, to note that this holder is one of five lifts, 195 feet in diameter and 226 feet high with steel tank, and has a capacity of 5,016,000 cubic feet. The pressure when on the fifth lift is 13.4 inches.

At the end of the 10-inch section, or approximately two miles from the compressor station, a 6-inch feeder line for the low-pressure system is taken off. This line runs westerly and southerly a distance of 4½ miles where it connects with another similar feeder line.

Additional feeder lines are taken off at several points, the extreme point of the longest feeder being eight miles from the compressor station.

At seven different points along the feeder lines district governors are located, the same being set for pressures varying from eight to fifteen inches.

The total lines supplied by pipe line No. 1 are 43 miles 895 feet in length, of which amount 34 miles 895 feet are within district No. 1 and nine miles are feeders for low-pressure mains.

There are 3500 meters in the district and the output will closely approximate 9,000,000 cubic feet per month.

Line No. 2 to High-Pressure District No. 2.

This district comprises the northeastern portion of the city of Los Angeles, and South Pasadena, Alhambra and Dolgeville, covering a territory irregular in shape with an approximate area of 8½ square miles, the nearest point being three miles from the compressor station.

The main feeder is 11 miles 1720 feet long and is made up of 10, 6 and 4-inch pipe. At three different points 4 and 6-inch laterals are taken off from the main line, one of these being approximately two miles long, through which gas is supplied to the Pasadena Consolidated Gas Company.

The total pipe lines in this district measure 54 miles 1141 feet. There are 3600 meters in the district and the output will closely approximate 9,750,000 cubic feet per month.

Line No. 3 to High Pressure District No. 3.

This district comprises the northwestern portion of the city of Los Angeles, East Hollywood and Hollywood, covering a territory with an approximate area of three square miles, the nearest point supplied being 1 mile 3820 feet from the compressor station. The main feeder line is 8 miles 1845 feet long and is made up of 8 and 6-inch pipe.

The total pipe lines in this district measure 26 miles 1166 feet. There are 850 meters in the district and the output will closely approximate 3,100,000 cubic feet per month.

Line No. 4 to Feeders for East Los Angeles Low-Pressure District.

This feeder line feeds the low-pressure distributing mains of the East Los Angeles district. A single line leads from the compressor station a distance of 4600 feet, when it divides into two mains, one 8700 feet long, and the other extending 5800 feet from the dividing point. The total line under high pressure is 3 miles 3260 feet and is made up of 8, 6 and 4-inch pipe. At six different points along these lines district governors are located, the same being set for outlet pressures of ten to fifteen inches.

Pressure.

The maximum pressure carried on the compressors is 45 pounds which, by this method of distribution, is, of course, the maximum pressure required for any district. This pressure is required, however, only on line No. 1 at the evening peak during the winter months, and with this pressure at the compressor a minimum pressure of ten pounds is maintained within the district.

During the time of filling the Pasadena holder a pressure of 40 pounds is maintained at the compressor, which, with the valve wide open, gives a pressure of one pound at the inlet of the governor before the station meters.

At the present time of year the maximum pressure is never above 27½ pounds for line No. 1; 10 pounds for line No. 2; 4 pounds for line No. 3, and 10 pounds for line No. 4, which pressures permit of ample leeway for any sudden offtake.

With the piping arranged so that the compressors can be operated separately or in parallel on any of the four lines, ample capacity is available for maintaining the required pressures with even a very great increase over the present peak consumption, and to date absolutely no trouble of any kind has been experienced in giving a satisfactory service on all parts of the system.

Cost of Compression.

Careful figures as to the cost of compression, based upon actual operating periods and conditions, show the same, including operating and fixed charges, to be slightly less than 1¾c per 1000 cubic feet.

THE HUMOROUS SIDE OF A GAS MAN'S LIFE.

By Wallace H. Foster.

In presenting this subject it has been the writer's desire to illustrate particularly such operating conditions of the wealthy San Francisco suburb which differ from those of the large cities or the smaller interior towns. There will be considered first the class of people supplied and their relations with the local company, and secondly the purely commercial side of suburban distribution.

As to the people, the suburban town is composed for the most part of merchants and professional men whose business is in the metropolis and whose homes are, for at least a portion of the year, in the suburb. While it would not be right to say that all of these consumers class as wealthy according to the standards of the day, yet there is no question but that the proportion of wealthy consumers is far and away above that in the large city or the small town away from the city.

There is, of course, a middle and a laboring class, but the local business district is limited, there are no factories employing large numbers of men, and the early rising hour deters the majority of this class from living further than necessary from its labor in the city.

Now assuming that a large percentage of the output of gas goes to wealthy consumers as compared with the cosmopolitan class of the great city or the small merchant or mechanic of your interior or manufacturing town, let us see the effect upon the ordinary transactions of the gas office.

In the first place the rate per thousand charged for gas is immediately up for comparison with the San Francisco rates. Not that the San Francisco rate could not easily be known by any consumer of gas within one hundred miles of the bay, but the fact remains that very little comparison of rates has been made between various towns and cities, although more of this is being done all the time. Your consumer, having his business in San Francisco and being really more vitally interested in the welfare of that metropolis than in the town of his residence, and being very probably a consumer in San Francisco as well, is sure to know the rate in that city and to compare it with the suburban rate. To him must be explained the difference in output and the increase in freight rates above those of terminal points. To his credit, the average consumer knows the argument to be well grounded, the hardest point to convince him upon being the variation in price between fuel and illuminating gas, and much persuasive eloquence is sometimes necessary to convince him that he should pay two dollars per thousand for lighting, and get the same gas for which he pays one dollar fifty for fuel.

Next, many of your consumers have servants in their kitchens, and if you can believe the ladies (and if you cannot, what hope is left for humanity?), everyone of these servants is a jewel and a perfect model of economy. Of course, even a lady may make a mistake, as, for instance, in one case where a particularly strong complaint came in with regard to the size of a bill. The office was assured that the Chinaman was an old family servant and that he was really the very most saving person in the world, and, were he not, the lady of the house gave her personal supervision to the kitchen so that there must have been something wrong with the meter.

Alas for fallen idols, an inspection at 10 o'clock disclosed the fact that both oven burners had been going since 7 when they had been lighted to make the breakfast toast!

Naturally, such damaging evidence was sufficient to close the argument.

With servants using gas, the accuracy of your meter is continually pitted against the word of a servant. It is needless to say that the meter is always wrong so far as the consumer is concerned.

In the matter of collections you are requested to mail the bill to the consumer's San Francisco office which you do regularly and promptly, making the bill out net. On the tenth of the month, no check appearing, you add fifty cents per thousand and try again, and about the time your new bill arrives you receive the consumer's check. You did all this years ago, but after facing the storm of indignant communications which even the stenographers must have trembled to write, knowing full well how the "old man's" spleen must have been irritated to bring forth such a flow of satire and invective, you gave it up and the memory of the gross rate exists in a column on your bills in which no figure ever appears.

Those bills which are paid at the office are paid by the women almost entirely, and such complaints as are made directly to the local office are made by the ladies.

This leads to one of the most peculiar phases of this suburban distribution; that is, the matter of complaints, whether regarding service or bills. It may be that your consumer has a few hundred shares of preferred P. G. & E. in his vest pocket, or he may know some of the august ones who rule on high—I was going to say the "higher-ups," but perish the thought; I refer to the Board of Directors,— or he may eat at the same club, or he may ride on the same train or boat with some one in touch with the San Francisco office.

At any rate he unfolds his tale to some one who has many more important things to think of, and in one, or two, or three days the complaint arrives at its proper destination, the local office, your consumer suffering meanwhile and working himself to a higher point of righteous indignation. One such instance is worthy of notice where a gentleman felt that the gas service was in such a condition as to warrant immediate investigation and wholesale reconstruction.

The dangerous condition of affairs was confided at a luncheon in San Francisco, and post haste (two days later in this case) the local office notified. The complaint list showed the minimum and the weekly report had stated that everything was running well, but there could be no mistake—some serious trouble existed. A personal investigation was required and a report forthwith.

No, the mains were not full of naphthalene, gas was not being delivered from the relief holder, no one had by-passed the purifiers, only—the consumer had failed to remove the lava tip before connecting a portable lamp!

On the occasion of the next complaint would the consumer place the complaint directly with the local office? Never! That might lead to a state of affairs in which the gas man would listen to complaints during business hours only, and each complaint would be registered at the complaint counter, a condition which every one knows can exist only in some future world.

Now as to the selling end of the business, the casual observer might expect a splendid revenue from these wealthy consumers, and in the days before the advent of electricity this was true, but with the wiring up of the old residences came a falling of illuminating revenue, and to create a demand

for fuel gas in the homes of the rich is by no means easy. With servants in the kitchen, the hot summer days do not bring thoughts of the cool and comfortable gas range to the housewife as they do to the woman who does her own work, and the French range is suffered to roar along whether the temperature is forty or ninety. However, the servant problem in the suburbs is by no means easy, and if Won Lung finds that the family on their return from golf or tennis has exhausted his supply of hot water his wrath is awful to behold. It was thus that the instantaneous water heater was introduced where the gas range was an impossibility.

The sale of appliances in the suburb is, however, a difficult proposition at best for several reasons. Although there are local papers, they are printed weekly, and as the San Francisco papers are at the door of the suburban home by 7 in the morning, little attention is paid to the local paper except for local news, and as for an advertisement it is worth practically nothing. Again, the local business district being small, and the stock in proportion, the commuter gets the habit of buying his supplies in San Francisco, and naturally applies this to gas appliances as well as to anything else. Consumers have been known to buy hot plates in San Francisco at $7.50 plus the express charges, when the same plate was being sold in the local market for $7.00.

The sale of gas arcs is also restricted because of the limited business district and the fact that people do not promenade the streets in the evenings as they do in the cities, thus offering no inducement to merchants to keep their stores lighted for the display of their wares. Cheap flat electric rates as against the necessarily high gas rate also work against the introduction of special illuminating appliances, and again the natural feeling of a company selling both gas and electricity that what does not go into one pocket will go to the other does not stimulate the offer of special inducements for the increase of illuminating sales.

It is the hope of the local gas man to see the vacant spaces in the town fill up with the cottages of small merchants and salaried men, for in these homes the housewife does the cooking and appreciates a gas stove and uses it with judgment and economy, and though the monthly bills may be less, the father of the family may be educated to read his own meter, and thus to know the correctness of his bill, and with fair treatment and good service will become and remain a friend of the gas company.

REPORT OF EXPERIENCE DEPARTMENT.

The Experience Editor herewith presents his annual round-up, and in so doing cannot refrain from congratulating this Association that so many members are present, all hale and hearty, for the annual conclave by the "sad sea waves." It is needless to remark that the past year has been a strenuous one for every gas man, and our meeting once in twelve months to exchange experiences is not alone a medium of recreation for each and every one of us, but is a profit to those whom we represent.

The responses to our request for contributions this year have not been as numerous as was anticipated, and the editor desires herewith to thank all who have so graciously answered his appeal. The paper which will now be presented is open for your discussion and criticism, but in so doing you are admonished to always bear in mind that little poem by Alfred Waterhouse, which runs:

"Put the hammer in the locker,
Hide the sounding board likewise;
Anyone can be a knocker,
Anyone can criticise;
Cultivate a manner winning,
Though it hurts your face to smile
And seems awkward in beginning,
Be a booster for awhile."

The following experience which we have entitled, "Electrolysis the Toreador of the Gas Main," is of much interest.

Investigation for a bad gas leak resulted in our finding that electrolysis had attacked our distributing system. This occurred on a small service pipe, and on an 8-inch W. I. high-pressure gas main. The service pipe had to be replaced, also the 8-inch high-pressure gas pipe. Careful tests were made to determine the relationship between the gas pipe and water pipes in this same street, and after considerable investigation, the trouble was found in a gas pipe that was bonded to the railroad track. This bond consisted of a single No. 8 copper wire bonded to the track and wrapped around the 8-inch W. I. gas pipe. When this bond was removed, the temporary bonds placed at the point where the pitting occurred were also removed and the entire trouble stopped.

The lesson to be drawn from this is that promiscuous bonding of the gas pipes to the railroad tracks or water mains should be discouraged, and no bonding should be done until a careful study has been made of the existing conditions. In this case the track was positive to the gas pipe and the current therefore flowed from the track to the gas pipe, which current was obliged to leave the pipe at some other point, which, in this case, was where the service pipe was pitted out and the 8-inch pipe destroyed. In general, it is not desirable, particularly in the case of the thin iron or steel pipe, to have same carry current, and precaution should be taken to avoid this. In spite of this precaution, however, a small amount of leakage current may enter this pipe and there is no objection to a bond being provided to remove this current. This bond, however, must be placed at a point where the gas mains are positive to the foreign property, to which we intend to bond.

In connection with the above we have an excellent article on "The Prevention of Electrolysis of Underground Pipes."

In general, there is no perfect method of getting rid of electrolytic action. The best method of procedure would, therefore, be to adopt the method that will reduce the effects of the current on the pipes within a reasonable limit, without putting an unreasonable burden of expense upon the street railroad companies. First of all, good bonding of the rails is absolutely essential. Second, sufficient metal in the track or supplemental conductors or a combination of both should be had so as to reduce the drop in the return circuit to a very small percentage. After the above conditions have been secured the next thing to be given attention is to see that the network of tracks such as are usually found in the heart of any city, of from moderate size up to the larger ones, are properly connected to the negative bus of the generating station. In general, it would be well to run a supplemental return conductor to each and every track passing within a radius of, say, 2000 feet from the station. The underground pipes at the nearest point to the station (negative) bus should be solidly connected to it. Concentric voltage surveys should be made beginning at some convenient point near the station and wherever any return conductor, whether it be on supplemental return or the track rails passing over the underground pipes, and the voltage surveys show that the pipes are positive to the return conductor a bond should be made between the pipe and conductor. Continuing these circular voltage surveys, bonding where indications justify and constantly increasing the radius of these surveys, a point will soon be reached where the voltage readings will be extremely low, where further bonding of pipes to rail would not be justified. It would be well to take readings at the various points of bonding between the pipes and the return conductors from time to time to determine their permanence or any change that may have been brought about by the extension of either the piping or street railway system in the proximity of each other, and if

indications show it be necessary additional bonds between the pipe and the return conductors be installed. The laying out and the installation of the above-mentioned system of reducing electrolytic action should be trusted only in the hands of an expert.

This experience goes to show how the gas man does things when it comes to thorough and proficient preparation for very particular and quick work.

"Changing location of a 12-inch main and drip pot, in a limited time."

Owing to the city building a storm drain, it became necessary to lower a 12-inch wrought-iron, high-pressure main for a distance of 300 feet, and to do so we were compelled to change a 80-gallon cast-iron flanged drip pot weighing 2,000 pounds to a point 150 feet from the location it then occupied. As this line is used to fill a 5,000,000-cubic foot holder, and also to supply a large high-pressure district, the job had to be done in a limited time, and much depended upon our preliminary work.

After uncovering the pipe for the required distance and cribbing the ditch, it being seven feet deep and in sandy soil, we supported the pipe in its original position by means of chain blocks and slings, and excavated under the main, as at one point it had to be lowered five feet. When everything was ready we closed the gate-valves, unbolted the flanges on the drip pot and raised it out of the ditch; removed the flanges from the main, split a coupling at the point where the drip pot was to be re-located, then lowered the main and with the chain blocks pulled the entire disconnected main (150 feet of 12-inch pipe) along in the ditch so as to fill the gap caused by the removal of the drip pot, thus leaving a gap in the new location. The pot was then lowered in place, flanges put on main and bolted to drip pot, and the other end connected with a special sleeve. This work was done, from the time the gates were closed until the gas was turned on again, by seven men in two and three-fourths hours.

The next experience relates how the "Bunco Man" buncoed the gas consumer, and is entitled, "The Gas Regulator that Didn't Regulate."

During the early part of the present year we were receiving complaints from many of our consumers, such as no gas, weak pressure, high gas bills, etc. Following our usual custom, which is to investigate the cause for all complaints of whatever nature, one of our gas inspectors unearthed a scheme that had been very successfully worked on a large number of consumers. It was done in this manner: A few weeks prior to the advent of these complaints, two men, apparently well versed in the art of convincing the innocent and unwary housewife, who is always looking for something that will allow her to use lots of gas, and rest assured that at the end of the month the gas company would present a very small bill, were offering for sale a small device, called a gas governor or regulator, that is easily attachable to the gas meter and which they claimed would regulate the flow of gas to appliances, and stating that the gas company was carrying too high a pressure, which caused big gas bills. Of course, this little device was so simple and inexpensive, and could be put into use so easily and quickly—the salesman explaining that in a trice he would put the device into immediate operation, by attaching it to the outlet connection of the meter, without notifying the gas company, and for the very nominal sum of $2.50 upwards to $10.00, judging always the calibre of the prospective customer's pocketbook, and the amount she would likely be induced to spend to honestly beat the gas company. The little device was installed and the busy consumer went on using gas without further worry and trouble, and with visions of how small the next gas bill would look.

The device is made of brass, conical shaped, the apex of the cone having an opening about one-eighth of an inch in diameter. The base of the cone is flanged and has spread enough to be securely held in place when the meter connection is screwed up. Within the cone is placed an ordinary white bead that is held in position by the insertion of a piece of perforated sheet brass and giving space for its rise and fall with the flow of gas. That you may more fully understand, I have for presentation a sample of the device, and will pass it among you for your inspection.

The working idea of this so-called regulator, in theory, at least, may be explained, thus: When the flow of gas at the appliance is shut off, the bead drops down and rests on the screen, allowing full opening at the apex of the cone. As the gas is turned on at the appliance the flow of gas through the cone raises the bead, suspending it upward, closing the hole at the apex of cone, thus tending to regulate the pressure and reduce the flow of gas.

But, lo! All who were enticed into purchasing this article were doomed to disappointment; it not only worked to effectually shut off the gas flow, and, instead of diminishing the gas bills, they were increased. For example: One case was brought to my attention of a consumer whose bill for a corresponding month the year previous was $2.70; his bill, after using the gas regulator, was $5.20, and the claim was that they used more gas than one year ago. Thus, the regulator, instead of reducing the gas bills, on the contrary, increased them, much to the dissatisfaction of the consumers, and, of course, in a case of this kind, as in many similar cases, the poor gas company is requested to rebate the increased gas bill caused by the consumer being fully convinced that he has now found a golden opportunity to beat the gas company.

"What Salt Water Did to Our Pump," is a valuable experience for those living on or near the Coast.

We had a shaft of our centrifugal pump corrode entirely through in six months' time. This particular piece of shaft was the tail of a 7-inch pump; the diameter of the shaft at the point where the corrosion occurred was one and one-fourth inches; the balance of the shaft on the other side of the impeller was two and one-half inches. From the tail bearing to the bronze runner, a distance of eight inches, the shaft was corroded in a taper form, starting with the diameter one and one-fourth inch down to one-fourth of an inch, where it broke right next to the runner. This, having occurred in six months, was a decided experience for our engineers. It was necessary to replace this shaft with a bronze one, on account of the pump handling sea water.

Our next is entitled, "Sudden Expansion—What Caused It?"

In our take-off pipe, carbon forms, and is, of course, cleaned out regularly, and is always cleaned prior to the cleaning of the tar from the wash-box. On one occasion after this take-off pipe had been cleaned and the carbon in it wet by means of a hose, a fire started in the carbon remaining in the pipe, and during the time of cleaning the wash-box an explosion occurred which did no damage but would have been serious for the operator had he been in front of the open pipe or doors of the wash-box. The opening o fthe wash-box was stopped with a damper and on top of this damper was piled about one foot of wet lamp-black. Just how gas got back from the washer through this damper and lamp-black to a small fire that

started in the off-take pipe, is still a mystery to the operator, as he goes through this same operation quite often and has never had but the one explosion.

Again, we have an interesting and valuable experience, showing how by-products may be handled, entitled, "Drying Carbon Fuel Brick Quickly."

During the present summer we suddenly found it necessary to have on hand a certain number of carbon fuel bricks containing not over ten per cent of moisture, for a test. This was the stipulation under a contract, which it was necessary either to strictly comply with or leave a loophole for the contractors to escape.

It should be borne in mind that carbon pressed in a brick press in the form of fuel bricks must contain at least twenty per cent of moisture as a binder, and pressing the bricks does not reduce the moisture to any appreciable extent. Of course, we could dry the material to almost any degree before pressing it, but it must contain at least twenty per cent of moisture at the time of pressing, in order to hold the brick together. Our time was very limited, and we had to have a certain number of bricks containing not over ten per cent of moisture on hand by a certain date, in order to comply with the contract. We were certainly in a predicament. Although we had a large quantity of bricks on hand, we had no way to dry them except, by the sun, and, as they had been made within a few weeks, there was not much chance that the sun had dried them over one or two per cent.

At last we hit upon a scheme which not only reduced the moisture to less than ten per cent, but did it in plenty of time for us to keep within contract requirements. Laying the bricks in the shape of a baker's oven, in stacks about seventeen feet long by ten feet wide by seven feet high, with a dividing wall cutting their width exactly in half, we placed a door on each side of the dividing wall, supported by a casement of fire brick, with a piece of angle-iron laid across the top to strengthen it. We then lit carbon fires inside the space, with the aid of kindling, and let the fire burn until test showed that the bricks were within the limit of moisture required. At the end of ten days the bricks had been reduced to five per cent of moisture. Each pile contained about five tons of brick, and the drying of the contract amount was a matter of necessary space only. We had our bricks dried before the time they were required for the test, and within the limit of the contract.

Last is an account of repairing a punctured gas main.

On Saturday afternoon, September 5th, the writer was very slightly shocked by receiving word that a high-pressure gas main under his charge, running along the County Road, and supplying a town of some six thousand people, had been broken off by a steam roller. Upon communicating by 'phone with the station having control of the pressure, he was relieved to learn that the gauge on the damaged line registered about the usual pressure. This was somewhat surprising, but good news, yet no time was lost in getting to the point of reported trouble, ten miles away, which distance was covered in a small, single-seated auto carrying three persons, in twenty-five minutes.

Arriving on the scene, we found the head foreman of the electric department on guard, and quite the master of the situation. Happening along just a few minutes after the accident, his attention was attracted by a noise resembling escaping steam. Seeing the roller ahead, he paid no further attention until it was overhauled and noted to be quiet and motionless. He, thereupon, retraced his steps to investigate, and learned that our good gas was being wasted in no small quantities, coming from two holes in the ground, two or three inches in diameter. Realizing at once that the long, steel spikes in the side-wheels of the roller had punctured the gas main, he arranged for word to be sent to the station, and then set about to stop the flow of gas—no easy task under sixty pounds' pressure. Sharpening a stick about eighteen inches long and about the diameter of the spikes, effort was made to force same into the hole in the main, but the escaping gas being deflected against the sides of the hole in the ground, made by the spike, expelled the loose earth in large quantities, and retreat was made. A much longer stick was then secured, and this time successfully forced into the opening. In this manner both punctures were very well closed.

The punctures were found to be about three-quarters of an inch in diameter, and were permanently closed by the use of sheet lead and saddles, which were made ready on the pipe and slipped quickly over the puncture as the sticks were removed, and then made tight. While these repairs were being made the pressure was lowered to ten pounds for twenty minutes.

It is needless to add that the main was at once lowered, to make it again two feet below the surface of the highway, and, we hope, out of danger from future road improvements.

NIAGARA'S POWER FOR ONTARIO.

Consul A. G. Seyfert writes from Owen Sound that the hydro-electric power transmission plan from Niagara Falls to the towns and cities of western Ontario has at last reached the period when the contract for the erection of the line has been let. The total length of line to be built is 293 miles, with 3,176 steel towers. The contract calls for a main line from Niagara Falls to Dundas, with lines from the latter place to Toronto, London, St. Marys, and St. Thomas, and was let to a construction company for $1,270,000, the lowest of 27 tenders, and includes all the lines in one contract. The contract will necessitate the use of 507 tons of aluminum wire, together with 140,000 pounds of telephone wire. The towers will be 66 feet high and consume 6,554 tons of steel to build them. The estimated cost of the towers is $621,000. The work is to be completed by December 1, 1909. The material for the construction of this gigantic electric power transmission scheme is to be Canadian made as far as it is possible to secure it.

SETTING A MARKET VALUE ON A WATER-POWER PLANT.

"The value of such a plant," so says Mr. Charles T. Main, mill engineer of Boston, "varies extremely with different conditions which govern the first cost, and with the character of the work done. The effect of the head, length of dam, length of canal, distance from canal to river, etc., increase or decrease the cost of construction. Very much better work is done in some places than in others, which increases the value and decreases the depreciation, so that no general rule can be given to cover all cases. The plant must be considered not alone, but in connection with the privilege, each being dependent upon the other, and each affecting the value of the other, as describd in the earlier part of this paper.

"For the water-wheels themselves, the average life of the wheel is probably about twenty-five years, while the casing might be allowed to outlive two wheels. Iron or steel penstocks, if taken care of, should last probably 100 years, but wooden feeders underground will not last fifty years. Wooden flumes, gates, and racks which are exposed to the weather will last about twenty years. Some wooden dams have lasted a great many years, but they are apt to get washed away in freshets. Stone dams, if properly designed and well built, will last for hundreds of years.

They were afraid to go home in the dark By?

-Same air-

THERE'S a kid named Van der Naillen
A great big heart has he,
He never takes a stronger thing
Than milk punch in his tea.
He is a jolly joker,
With all he has a laugh,
And tho' he plays some poker
He knows the chips from chaff.
Last night he stepped upon a snake
Which made the boys with hearty laughter shake.

CHORUS:

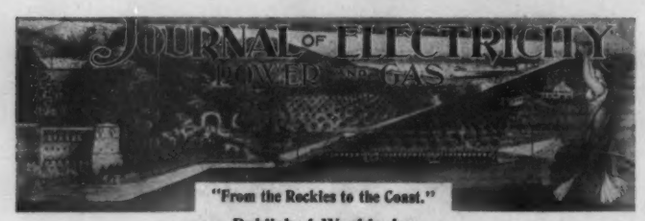
MEMBERS DEAR—You are queer,
I'm sure that the pressure is low.
Every day the people say
You're robbing them of the dough,
So you hike away to the P. C. G. A.
Singing just like a crow—
There is no gas like mine,
Although the people say it is not so.

THERE'S Lowe and Brother Werry,
Two wise old gulls are they,
And Boardman sad, and Osbourne gay,
And some who never pay.
There's Miller and his gavel,
And Britton with his gall,
And Adams with his souvenirs,
And Keyes who says high ball.
There's Pabst who makes the famous Portland light,
And Clark so ready for a fight.

THERE'S dandy little Newbert,
A dresser swell they say,
Who changes his cravats, 'tis said,
Some twenty times a day.
And stalwart Johnnie Clements
Who does the hula hula,
And dear old Martin, John the big,
And Jones you can not fool-a,
And others too of whom much we would say,
But this is now too long a lay.

THE Swanton Fred, the dashing,
And Lind, his aide de camp,
Who make this happy gathering,
Look like the big Bong Tong.
Three cheers for Freddie S.
May he live long and well,
And never know a gas man's life,
Which means not knowing—well
We hope he always will be good and
Not be lonesome—that is understood.

As sung at the banquet of the Pacific Coast Gas Association, Sixteenth Annual Convention, September 16, 1908.



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SHALL WE TAX OURSELVES?

This is a people's government after all, and as a nation we need to get back to solid ground where stood the men who founded this form of government. We want to take ourselves back to where we started from. Stand with bared head and read the inscriptions on the monuments out of Boston that commemorate the men who fought for a something that we who are touched with modernism are apt to set to one side and forget.

The very basis of our government was a resistance to the unjust tax oppressions of the central government. Would you as a citizen of California consider it just for the federal government to levy a direct tax upon you to reforest another State that had been stripped of its timber?

There are many methods of taxation. They taxed windows in England, they tax the earning power of a dwelling, and matches and wines and medicines have been taxed in America. The general practice is now to tax values. Would you be willing to be taxed by the federal government one-half of one per cent on your lands and property for the purpose of reforesting some State on the Atlantic seaboard? Probably not.

Would you be willing to have a tax levied against you by the federal government for the purpose of reforesting another State, and to have the amount of that tax measured and determined by the quantity of electric current you used? We imagine not, and yet this is precisely what it is proposed to do.

It must be perfectly plain to you that a governmental burden of say one hundred thousand dollars a year placed on hydro-electric companies must find its way into the rate charged, and that you pay your pro rata of that hundred thousand dollars annually to the government just as though it were a direct tax on you. Making the electric power company the collector does not lessen your burden, nor change its character nor divest it of its tax feature, nor divert it from its original creator and ultimate collector, the government.

When the farmer who is wresting from the arid and famine-stricken plains his little holding, and is converting a treeless waste into a garden spot of productivity, he may know that every gallon of electrically lifted water flowing through his irrigation ditches has paid its tribute to the reforesting of a distant State. When at the end of the season his crops are harvested and marketed, and he sits under his electric light figuring up the net results of the year's labor, he may deduct from his scanty profits a given sum for excess charges on account of the government tax on his electric pump, his electric light, his electric churn, and other devices.

This is not a pleasant thing to consider. But it is not overdrawn. It is true, and it applies to every individual consuming electric power furnished by corporations who unfortunately have fallen in the clutch of the Forest Service.

SOCIALISTIC TENDENCIES.

There are a number of good people who shudder at the idea of granting any privilege to a corporation that may result in the creating of of the people must be reserved a monopoly. The "sacred rights" even though the use of those "sacred rights" is denied the people.

Let us take a virgin highway, innocent of rails and traversable only by teams and pedestrians. The people have a "sacred right" and a "valuable franchise" on that street. But let the people walk, we must not part with that "sacred right."

Along comes a fellow who makes application for the franchise. He may be the highest bidder, or he may offer the largest percentage of gross income, or do whatever else the law requires. He builds his railroads and his cars are crowded with passengers; the street takes on a new life and buildings go up its entire length. Here are increased taxes coming to the State. But the "sacred rights" of the people have been frittered away. The more passengers carried on this road the more advantage its operation has brought to the general public, and the greater the public disadvantage suffered by its non-use.

It would be idle to here discuss the fellow who believes that the government should own and operate this road. The thrifty American municipalist who mixes with his socialistic tendencies a fine spirit of commercialism would drag the government off its pedestal and force it to go into trade, like a huckster looking for profits.

It is contended that the granting of any water rights to hydro-electric companies would create a monopoly.

Well?

It would serve a great many people with a something they need and are now denied. It would give light to municipalities; it would give power to industry; it would furnish the farmer with a cheaper means of raising water from subterranean flows to enrich the arid surface soil; it would increase the crop output of the State; it would render worthless land productive; it would cause the desert to bloom; it would reduce the cost of crop production; it would furnish power to transportation companies; it would conserve the surface waters, conserve the coal and the oil resources of the State, and it would encourage development along lines of endeavor not now dreamed of. And yet it would not lessen to the extent of a single drop of water the flow of the stream, but would turn it all back again for use. But the producing and furnishing agent would be a monopoly.

What of it?

The only thing we have to fear from a monopoly is unjustly high rates. The federal government itself proposes to tack on penalties that of themselves will operate to increase rates, penalties that for all time would enter into the fixed charges of the corporation and for which they would be always permitted to tack on an extra charge to the consumer.

But it is a monopoly.

We need not fear high rates whether it be a monopoly or a concern having open competition. This dreaded monopoly cannot charge more than a fair rate. Every city of the West, even down to cities of the sixth class, every county in the State, is by law empowered to regulate rates through its local governing board.

The highest privilege of ownership is to fix the price at which you will sell your wares. This privilege is denied to public service corporations. The State reserves the right to regulate their charges. Then what becomes of your monopoly? Its fangs are drawn. It has no terrors for reasonable men.

The painful feature of the condition is that some one is making money through converting to private profit something that once belonged to the State, something that served neither State nor people until harnessed and employed by private capital. There is something pitifully weak about the mental equipment of the man who is afflicted with this warped view.

PERSONAL.

P. H. Coolidge, manager San Francisco office of the Western Electric Co.' leavs for Seattle the latter part of this week.

O. N. Guldlin, President of the Western Gas Construction Company of Fort Wayne, Indiana, was in San Francisco during the past week.

Bertam M. Downs has recently been elected Vice-President of the Brookfield Glass Company, with offices in the U. S. Express Building, New York City.

W. S. Dix, Pacific Coast representative of the R. Thomas & Sons Co., of East Liverpool, Ohio, has returned to San Francisco after an extended trip throughout the Northwest and also the South.

M. McIntyre, formerly Assistant Division Superintendent for the Detroit Electric Railroad Co., has been appointed Superintendent of the San Francisco, Vallejo and Napa Valley electric railroad, with headquarters at Napa, California.

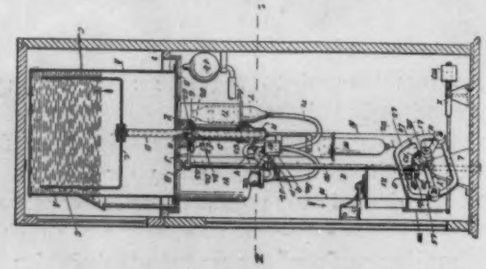
OBITUARY.

Albert P. Seymour, for many years active in Pass & Seymour, Inc., manufacturers of electrical specialties at Solvay, N. Y., died September 13, at his residence at Monrovia, Cal. On account of failing health in 1906 he retired from the business, disposing largely of his interests, and has since resided in Monrovia. He was connected for some years with the Electric Light and Power Company, now the Syracuse Lighting Company and later became a member of the firm of Pass & Seymour, which became Pass & Seymour, Inc.

PATENTS

APPARATUS FOR THE ANALYSIS OF GAS MIXTURES. 897,900. William S. Hubbard, Leicester, England.

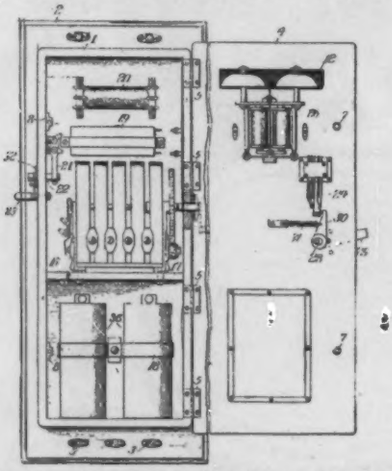
In apparatus for automatically analyzing mixed gases and indicating the proportion of one of them, an operated spindle having exact vertical stroke, an operated valve having quick movement at each end of the spindle stroke, a gas pump, a valve and valve box with ports for distributing the gases, a measuring vessel, an absorption vessel, means for



conveying the remaining gases after absorption to the underside of a liquid sealed re-measuring bell suspended in tank attached to spindle having exact stroke, bell suspended to a balanced lever with pen and means for recording on a moving chart the extent of its descending movement when the re-measuring vessel does not receive the same quantity of gas as was expelled by the first measurer, means for connecting to the air the pipe from the absorbing vessel to the re-measuring vessel through valve box and valve, after the record has been made on the moving chart.

SIGNALING APPARATUS. 897,866. George F. Atwood, East Orange, N. J., assignor to Western Electric Company, Chicago, Ill.

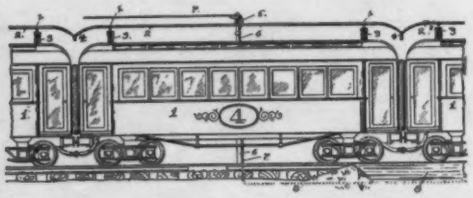
In a telephone set, the combination with an inclosing case provided with a door having an opening therein, of a gasket interposed between said door and the case, a screen or grating secured across said opening, a telephone bell mounted on the door with its gongs in proximity to said open-



ing, a telephone switch and switch hook also mounted upon said door, a shaft extending through the door and connecting the switch with the switch hook, a generator mounted within said case and having a shaft extending through the wall to the exterior thereof, a stuffing box surrounding said shaft, a circuit changing switch mounted on the interior of said case; a shaft extending from the switch through the wall of the case to the exterior thereof, and an actuating handle secured to the outer end of said shaft.

SYSTEM FOR TRANSMITTING ELECTRIC CURRENTS TO CARS. 897,965. John J. Eagan, San Francisco, Cal.

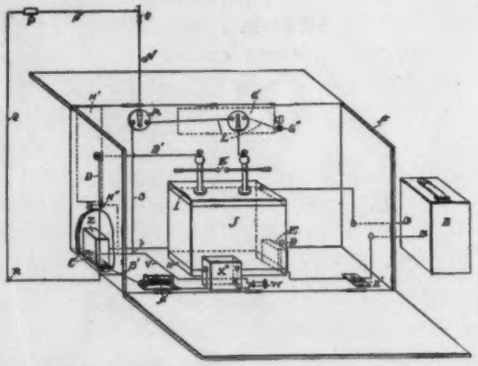
In a system for transmitting electric currents to cars, a plurality of poles supporting current transmitting horizontal arms, main feed wires insulated at the apex of said poles,



branch feed wires leading to said arms, mutually engaging rods curving downwardly at their ends to contact with said arms and becoming gradually thinner to such ends, spiral springs out of contact with said rods mounted on said cars, and vertical wires sustained by said springs interiorly to engage said rods.

WIRELESS TELEGRAPH APPARATUS. 898,197. Halsey Dunwoody, U. S. Army.

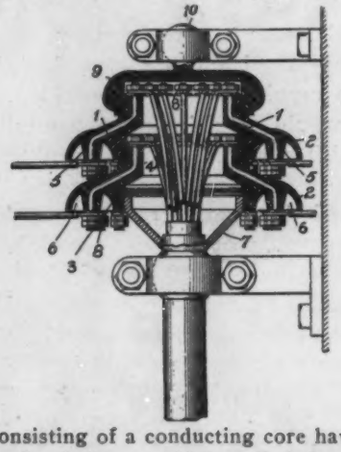
In a wireless telegraphic apparatus, the combination of



a wave transmitter, an aerial connected with the same, a ground connection for said aerial, and a current separator or rectifier containing silicon and carbon, in said aerial between said transmitter and said ground.

TERMINAL FOR ELECTRIC CABLES. 898,097. Charles W. Davis, Edgeworth, Pa., assignor to Standard Underground Cable Company, Pittsburg, Pa., a corporation of Pennsylvania.

A terminal for cables having in combination a body sec-



tion or unit consisting of a conducting core having a body of self-supporting insulating material molded thereon, the outlet end of the core extending outwardly through the insulating material in a direction radial or approximately radial to the center of distribution and a cap supported by the unit and protecting the inner end of the conducting core.

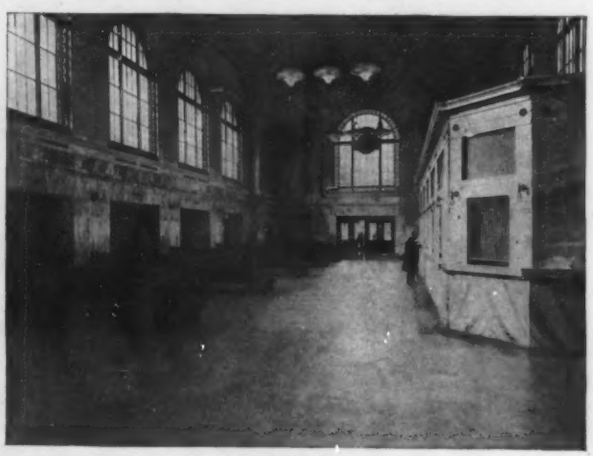
INDUSTRIAL

ILLUMINATION OF RAILROAD STATION.

The Union Station at Schenectady, N. Y., besides being one of the most beautiful on any of the New York Central lines, has been pronounced by experts to be one of the best lighted depots in the country, and the same opinion is voiced by all who have seen the station illuminated. When the lighting installation was under consideration, careful attention was paid to the lighting units from an esthetic standpoint as well as the utilitarian, and as a result they harmonize well with the gray marble finish of the station interior.

G. E. Arc Lamp with Concentric Diffuser.

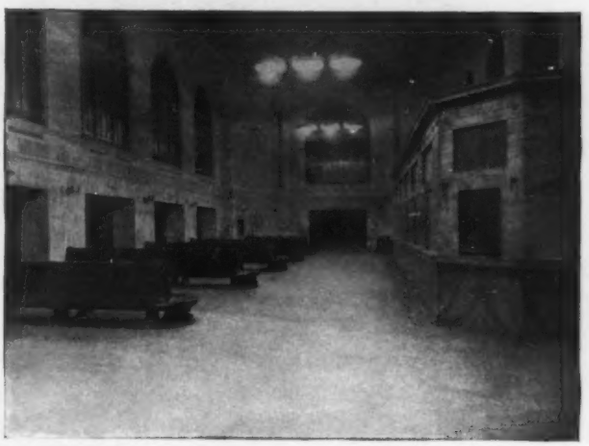
The main waiting room is lighted by General Electric high-current arc lamps equipped with concentric diffusers and opal shades, there being three fixtures suspended from the ceiling and three 8-ampere arc lamps in each fixture. Each lamp is operated in multiple from the alternating-current, 60-cycle supply circuit. As auxiliaries to the main lighting units, incandescent lights with frosted globes are supported in neat-appearing fixtures on the side walls.



Daylight Illumination of Station.

Although the arc lamp shown in Fig. 1 is not of the type used in this installation, the illustration will serve to show the relative positions of the diffuser and shade. The lower shade of light opal glass serves to direct the greater portion of the light against the under side of the porcelain-covered metal reflector, which, it will be noticed, is slightly cone shaped and corrugated. The corrugations serve to thoroughly diffuse the light, the rays being directed outward and downward at every conceivable angle. The resulting illumination is soft and restful, and the light penetrating to all parts of the room eliminates harsh and unnatural shadows.

Comparing this method of lighting with direct lighting, i. e., with arc lamps without diffusers, the consensus of opinion among engineers and architects is that it is by far the better. Although the intensity of the illumination with this method is relatively quite low it is easier to read or to see any object in the room, and the general effect is more restful than with direct illumination.



Night Illumination of Station by High Current Arc Lamps with Concentric Diffusers.

The accompanying illustrations showing the lighting of the station by day and by night, while giving a general idea of the installation, fail to show the true beauty and effectiveness of the illumination. The following tabulation of data is of interest and may serve as a basis of comparison with other installations:

Length of room	103 ft.
Width	44 ft.
Area	4,532 sq. ft.
Number of arc lamps	9
Watts per lamp	620
Total kilowatts	5.58
Watts per square foot	1.22
Height of lamps from floor	23½ ft.

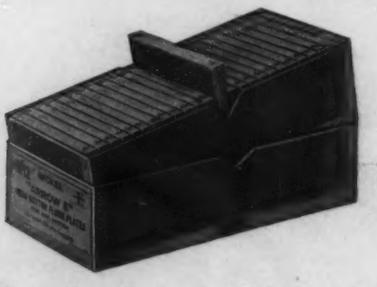
CUTLER-HAMMER DIMMER INSTALLATIONS.

The Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., through their Pacific Coast agents, Messrs. Otis & Squires, have lately made several sales of the well-known "Simplicity" interlocking dimmers to the following theaters: New Orpheum, Old Orpheum, Valencia, Washington Square, all of San Francisco, and the Novelty Theater, of Oakland. The bank to be installed in the New Orpheum Theater is very complete, comprising sixty-seven plates arranged in four banks, with individual levers for each plate and master levers for each bank, all interlocking, so that any plate or combination of plates may be operated at once by means of the master lever.

A MODERN PACKAGE.

The Arrow Electric Company, of Hartford, Conn., manufacturers of the "Arrow E" line of snap switches, have recently adopted a method of packing their switch-plates which is very much superior to the method in vogue in the past.

The switch-plates are packed individually in cardboard cartons, but, in addition, they are now packed in specified quantities in heavy cardboard boxes. As shown in the ac-



companying illustration, the box is notched on the sides, facilitating the removal of the first few plates. The boxes, when shipped from the factory, are sealed, and insure their reaching the buyer in their original condition.

The jobber and contractor who take a pride in the appearance of their shelf stock, will undoubtedly appreciate the advantage and convenience of this method of packing.

HOLOPHANE ARCS WITH TUNGSTEN LAMPS.

Official announcement is made by the engineering department of the National Electric Lamp Association that it is now safe and practicable to burn 40 and 60-watt tungsten lamps at an angle. This means that these lamps may now be used with the popular Holophane arc.

With characteristic conservatism the Holophane Company has waited for official sanction from the lamp engineers before recommending this unit with tungsten lamps, although for many months it has been well-known that these lamps could be so burned without danger.

With the sanction of the engineering department of the National Electric Lamp Association and the favorable experience of its customers, the Holophane Company is now recommending the Holophane arcs for all classes of commercial services with tungsten lamps of the 40 and 60-watt sizes. Tests showing the distribution and efficiency of Holophane arcs so equipped are now being made.

TRADE CATALOGUES.

Bulletin "A" from the Nernst Lamp Company, of Pittsburg, Pa., gives some interesting facts regarding the Westinghouse Nernst lamp.

The General Electric Company, Schenectady, N. Y., describes, in Bulletin No. 464, its new line of sewing-machine motors, as adapted to domestic use, dressmaking and tailoring, and for light manufacturing purposes.

The Electric Storage Battery Company, of Philadelphia, has just issued "Hand Book IP," which is a publication of special interest to dealers and contractors. It treats of the application of the "chloride accumulator" to small, isolated electric lighting and power plants for factories, residences, etc., where electric service from central stations is not available.

It shows how the advantages of a 24-hour electric service are made possible by the use of a battery of "chloride accumulators," entering fully into the subject and giving illustrations of the types of batteries and switchboards required for installations of different capacities. Specifications and prices for complete installations are given.

MARSHALL "ECONOMY" TOOL.

Ever since the electrical business began it has been customary to strip the insulation from ends and sections of wire and cord in a tedious, unworkmanlike and unsafe manner with a knife. Not only was the process slow, but the wires were frequently scored, or the strands in the cord cut off, making expensive breaks both before and after the work was finished, and the workman who did the work frequently cut his fingers and thumbs with the knife.

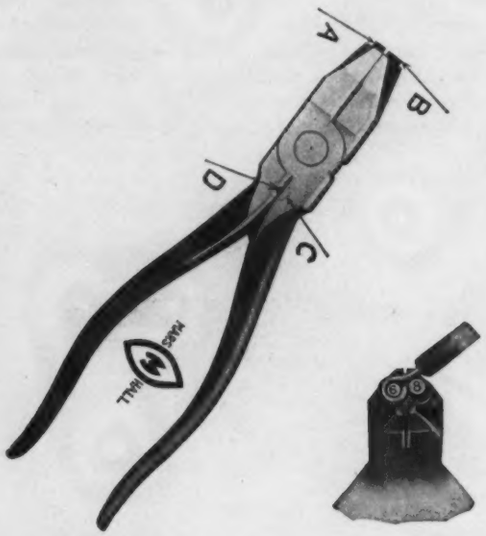


Fig. 2.

Fig. 1.

The Marshall "Economy" Tool was designed after many years of patient effort to overcome these troubles. The tool itself is extremely simple and at first glance looks like a pair of ordinary side-cutting pliers, for all uses of which it is an excellent substitute, in addition to the special features of stripping and looping wire.

The operation of the tool is as follows, reference being had to the accompanying cuts:

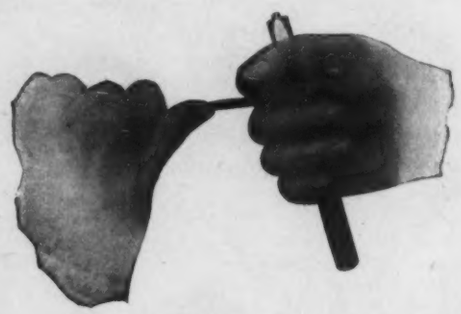


Fig. 3.

To Strip Lamp Cord—Fix cord exactly in hole C-D, close the jaws tightly. One pull strips off the insulation without cutting a single strand. (See Fig. 3.)

To Strip Rubber Covered Wire—Place wire in the hole C-D, close the jaws and slightly rotate. One pull strips off the insulation without scoring the wire. (See Fig. 3.)

Looping Wire Ends—Catch the wire between the studs on plier nose close to the end. Roll the wire around the stud that fits the size of screw desired. One motion makes a perfect eye. A backward motion, with jaws released, straightens the eye and makes it central with the wire. (See Fig. 1.)

NEWS NOTES

FINANCIAL.

San Francisco.—The Rio Bravo Oil Company has levied an assessment of 2 cents per share, delinquent October 26.

Fresno, Cal.—The Laton Oil Company, of this place, has levied an assessment of 10 cents per share, delinquent October 8.

Santa Barbara, Cal.—Alfred Edwards, a local banker, has bought $40,000 of water bonds of this city at a premium of $141.

Newman, Cal.—The City Council has adopted a resolution affirming the necessity of acquiring a municipal water works system.

Madera, Cal.—The Town Trustees have ordered the drawing up of a proclamation calling a special election to vote on a bond issue for a municipal water plant.

San Francisco.—After an interval of some months the Truckee Electric Light & Power Company has resumed the payment of ten cent monthly dividends.

Bakersfield, Cal.—An assessment of two cents per share has been levied on the capital stock of the McKittrick Oil Company, delinquent September 19th.

San Francisco.—The Inverness Land & Water Company has levied an assessment of $.400 per share on the capital stock of the company, delinquent September 23d.

San Diego, Cal.—The American Light and Water Company and the Rudolph Kleybolte Company have agreed to take up the $261,000 water-bond issue still unsold, thus insuring the continuance of work on the water works.

Red Bluff, Cal.—At the meeting of the stockholders of the Pacific Power Company a few days ago a new board of directors was elected and an assessment of five cents per share was levied on the capital stock of the company.

San Francisco.—The offer of E. H. Rollins & Sons and N. W. Harris & Co. to pay the city $3,514,520 for bonds to the amount of $3,280,000, being the first installment of the new bond issue, has been accepted. Of the bonds issued, $1,080,344 goes for an auxiliary water system.

Los Angeles, Cal.—Edwin R. Fox has brought suit against the Board of Public Works, the City Auditor, and the City Treasurer to enjoin them from building the jawbone section of the Owens River aqueduct by day labor and to force the awarding of the contract to a private individual or firm.

San Francisco.—The earnings of the properties of the California Gas & Electric Corporation covered by the unifying and refunding bonds for the twelve months ending July 31, 1908, are: Gross earnings, $7,830,392; operating expenses, etc., $5,235,408; sinking funds, $225,060; profits, $2,369,924; interest, $444,700; surplus, $1,925,224.

San Francisco.—City Engineer Manson has filed with the Board of Supervisors a report on the proposed Hetch Hetchy and Lake Eleanor water system and will urge that an election be called at once to vote upon the issuing of bonds to the amount of $500,000 to secure the city's title to the land, as well as to vote on the proposition of accepting the grant of the Sierra water right from the United States Government.

San Francisco.—It is given out that the Southern Pacific Company has been successful with its tests with gasoline motor cars and that these will be used extensively in many parts of the State. The cars will be used to meet the competition of the Northern Electric Company in the Sacramento Valley and in competing with electric lines in Fresno and elsewhere.

TRANSMISSION.

Quincy, Cal.—O. C. Pratt and C. G. Zscheckelt have petitioned the Board of Supervisors for a franchise to erect a pole and wire line through Indial Valley and in the streets of Greenville for the transmission of electricity for light and power purposes.

Redding, Cal.—Erick H. A. Nordin, electrical engineer for the Northern Light and Power Company, has made a survey for the pole line of the company in the streets and alleys of this city. The company hopes to begin delivering power in Redding about January 1st.

Los Angeles, Cal.—Formal application has been made by the Edison Electric Company to Captain A. A. Fries, United States District Engineer, for permission to string its power transmission lines across the entrance to Long Beach harbor at a height of 140 feet along the drawbridge of the Salt Lake Railroad.

H. P. Wilson, vice-president of the Great Western Power Company, who has been in San Francisco, says of the recent rumors in regard to the company: "There has been absolutely no talk of a merger with any other concern. Harriman has never approached us. Our association with railroad people in the East is such that if anything of the kind were contemplated we would know of it. We are an independent operating company in the business of selling electric power. When we made application for a franchise in Sacramento recently it was in good faith. There has been no agreement, either written or implied, between our company and the Pacific Gas & Electric Company. Our product is for sale to real customers. Nor are we associated in any way, shape, or manner with any of the power or electric companies here. The Great Western Power Company has up there at Big Bend the largest hydraulic power plant in the world. It is larger than any individual power plant in the world, larger than any individual plant at Niagara Falls. During the whole time of the financial panic we kept 1,100 men at work there night and day, and we paid them in gold coin right along, when the rest of the State was using clearing house certificates. We are spending $10,000,000, exclusive of $2,000,000 we are to put in an auxiliary steam plant at the foot of Seventh Street, Oakland, on which preliminary work has just been begun.

INCORPORATIONS.

Los Angeles, Cal.—The Templor Rancho Oil Company has been incorporated with a capital stock of $1,000,000 by H. B. Guthrey, M. E. Ward, and J. R. Riggins.

San Francisco.—The Anaconda Oil Company has been incorporated with a capital stock of $100,000 by C. A. Son, Julius Levy, Julian Hart, Morris Mitau, and Julius Behrend.

Woodland, Cal.—The Davis Water Company has been incorporated with a capital stock of $10,000 by G. J. Haussler, R. W. Wiese, G. K. Swingle, J. F. Chiles, and W. D. Chiles.

Oakland, Cal.—The Tuolumne Water Power Company has been incorporated here with a capital stock of $1,000,000 by Warren Gregory and H. H. Rolfe, of San Francisco; Winfield Dorn, of Oakland; George H. Whipple, of Alameda; and J. S. Lamson, of Berkeley.

Salinas, Cal.—The Gavette Oil Company has been incorporated here with a capital stock of $500,000 by W. H. Dunphy and J. J. Caffrey, of San Francisco; Frank Barrett, of Palo Alto; W. N. Sherman, of Los Angeles; and G. R. Randall, of Parkfield.

TRADE MARKS

Classified List of Advertisers, Manufacturers, Manufacturers' Agents and Dealers, with Classes of Material They are Prepared to Furnish.

There is a court of arbitration to which the manufacturer can appeal without the consent of his competitors. It is composed of the great buying public—the consumer—who will listen with a willing and eager ear to the story of quality.

Take your case before this court and convey to it the enthusiasm you feel for your goods. Clinch this enthusiasm with your strongest arguments and state your reasons for appreciation.

SHOW YOUR TRADE-MARK

Explain how this trade-mark or name will identify your goods, prevent substitution and protect the purchaser. If this be properly done, victory will be yours.

Bold face type shows manufacturers and manufacturers' agents. Italics show jobbers who carry a complete line of these goods.

ADAPTERS

LAMP ADAPTERS

Benjamin Electric Mfg. Co.
Bryant Electric Co.
Dale Co.
General Electric Co.
Hubbell, Harvey.
Marshall Elec. Co.

ALARMS

BURGLAR ALARMS

Edwards & Co.
Electric Goods Mfg. Co.
Partrick, Carter & Wilkins Co.
Western Electric Co.
**Brooks-Follis Electric Corpn.*
**Electric Appliance Co.*
**Holabird-Reynolds Electric Co.*
**Standard Electrical Works*
**Sterling Electric Co.*

FIRE ALARMS

Edwards & Co.
Western Electric Co.

WATER ALARMS

Partrick, Carter & Wilkins Co.

ANCHORS

Klein & Sons, Mathias.
**Brooks-Follis Electric Corpn.*
**B. F. Kieruiff, Jr. & Co.*
**Holabird-Reynolds Electric Co.*
**Klein & Sons, Mathias*
**Standard Electrical Works*
**Sterling Electric Co.*
**Western Electric Co.*

ANNUNCIATORS

Edwards & Co.
Electric Goods Mfg. Co., "Ross," "Rivol," "Perfect," "Noxall."
Partrick, Carter & Wilkins Co., "King."
Standard Electrical Works, "C. & S."
Western Electric Co.,
**Brooks-Follis Electric Corpn.*
**Electric Appliance Co.*
**Holabird-Reynolds Electric Co.*
**Sterling Electric Co.*

ARMS

CROSS ARMS

Western Electric Co., "Walworth & Neville."

MAST ARMS

Electric Appliance Co., "Cutter."
Ft. Wayne Electric Works.
Western Electric Co., "Fletcher."

TELEPHONE TRANSMITTER ARMS

Dean Electric Co.
Electric Appliance Co., "Eaco."
Western Electric Co.,
**Brooks-Follis Electric Corpn.*
**Holabird-Reynolds Electric Co.*
**Standard Electrical Works*
**Sterling Electric Co.*

ASBESTOS

Johns-Manville Co., H. W.

BATTERIES

OPEN AND CLOSED CIRCUIT WET BATTERY

Electric Goods Mfg. Co., "Samson," "Noswas."
Partrick, Carter & Wilkins Co.
Western Electric Company
**Brooks-Follis Electric Corpn.*
**Electric Appliance Co.*
**Holabird-Reynolds Electric Co.*
**Standard Electrical Works*
**Sterling Electric Co.*

DRY BATTERIES

Electric Appliance Co., "1900."
Electric Goods Mfg. Co., "Samson Semi-Dry."
Western Electric Co., "Blue Bell," "Liberty."
**Brooks-Follis Electric Corpn.*
**Holabird-Reynolds Electric Co.*
**Standard Electrical Works.*
**Sterling Electric Co.*

MEDICAL BATTERIES

Partrick, Carter & Wilkins Co.
**Brooks-Follis Electric Corpn.*
**Electric Appliance Co,*
**Holabird-Reynolds Electric Co.*
**Standard Electrical Works.*
**Sterling Electric Co.*
**Western Electric Co.*

STORAGE BATTERIES

Electric Storage Battery Co.,
Westinghouse Machine Co.

BELLS

ELECTRIC BELLS

Edwards & Co., "Rex," "Lungen."
Electric Appliance Co., "Ansonia."
Electric Goods Mfg. Co., "Victor," "Dandy," "Tyrolean."
Partrick, Carter & Wilkins Co.
Western Electric Co., "Hawthorne."
**Brooks-Follis Electric Corpn.*
**Holabird-Reynolds Electric Co.*
**Standard Electrical Works*
**Sterling Electric Co.*

ELECTRO-MECHANICAL GONGS

Edwards & Co.
Electric Goods Mfg. Co.
Marshall Elec. Co.
Partrick, Carter & Wilkins.
**Brooks-Follis Electric Corpn.*
**Electric Appliance Co.*
**Holabird-Reynolds Electric Co.*
**Standard Electrical Works*
**Sterling Electric Co.*
**Western Electric Co.*

Classified List of Advertisers—Continued

MAGNETO BELLS

Dean Electric Co.
Electric Appliance Co., "Eaco."
Electric Goods Mfg. Co.
Kellogg Switchboard & Supply Co.
Standard Electrical Works, "C. & S."
Western Electric Co.
**Brooks-Follis Electric Corpn.*
**Holabird-Reynolds Electric Co.*
**Sterling Electric Co.*

BOILER

Moore & Co., Chas. C., "B & W."
Henshaw-Bulkley & Co.
Keystone Boiler Wks., "Parker."
Standard Elect'l Wks., "Robb-Mumford."
Tracy Engineering Co., "Edgemoore."

BOXES

WALL BOXES

Benjamin Elec. Mfg. Co.
Bossert Elec. Const. Co., "Bossert."
Chase-Shawmut Co., "Knockout."
Chicago Fuse Wire & Mfg. Co. "Union."
Cutter Co., The, "Munit."
Electric Appliance Co., "T. & B."
General Electric Co.
Harvard Elec. Co.
Holabird-Reynolds Elec. Co.
John R. Cole Co., "Bossert."
Krantz Mfg. Co., H., "De Rycke."
Standard Elect'l Wks., "M. & M."
**Brooks-Follis Electric Corpn.*
**Sterling Electric Co.*
**Western Electric Co.*

BRACKETS

DESK TELEPHONE BRACKETS

Dean Electric Co.
Western Electric Co.,
**Brooks-Follis Electric Corpn.*
**Electric Appliance Co,*
**Holabird-Reynolds Electric Co.*
**Standard Electrical Works*
**Sterling Electric Co.*

IRON POLE BRACKETS

Benicia Iron Works
Electric Appliance Co., "Cutter."
Pierson, Roeding & Co.
Western Electric Co., "Fletcher."

BURNERS

ELECTRIC GAS LIGHTING BURNERS

Electric Goods Mfg. Co., "Advance."
Edwards & Co.
Welsbach Company
Western Elec. Co., "Edwards."
**Brooks-Follis Electric Corpn.*
**Holabird-Reynolds Electric Co.*
**Standard Electrical Works*
**Sterling Electric Co.*

CABLES

SUBMARINE AND LEAD-COVERED

American Electrical Works.
Electric Appliance Co., "Paranite."
General Electric Co.
Habirshaw Wire Co., "Habirshaw."
National Conduit & Cable Co., "National."
Okonite Co.
Roebling's Sons Co., John A., "Tolma."
Safety Ins. Wire & Cable Co.
Standard Elect'l Works, "Simplex."
Standard Underground Cable Co.
Simplex Electrical Co., "Simplex."
Western Electric Co., "Hawthorne."

PAPER INSULATION

Nat'l. Conduit & Cable Co.
Western Electric Co.

CARBONS

ARC LIGHT CARBONS

Brooks-Follis Elec. Corp'n, The, "Siemens."
Reisinger, Hugo, "Electra," "Nuernberg."
**Electric Appliance Co,*
**Holabird-Reynolds Electric Co.*
**Standard Electrical Works.*
**Sterling Electric Co.*
**Western Electric Co.*

CIRCUIT BREAKERS

Cutter Co., The, "I-T-E," "Dalite."
Ft. Wayne Electric Works.
General Electric Co.
Kieruiff, Jr., & Co., B. F., "Hartman."
Western Electric Co., "I-T-E," "Dalite."
Westinghouse Elec. & Mfg. Co.

CLEATS

FIBRE CLEATS.

Blake Signal & Mfg. Co.

PORCELAIN CLEATS

General Electric Co.
Holabird-Reynolds Electric Co., "Electric Porcelain."
Thomas & Sons Co., R.
Weber Electric Co., H. D. Sears general sales agent.
Western Electric Co., "Thomas."
**Brooks-Follis Electric Corpn.*
**Electric Appliance Co.*
**Standard Electrical Works*
**Sterling Electric Co.*

WOOD KNOBS.

Blake Signal & Mfg. Co.

CLUSTERS

FIXTURE CLUSTERS

Benjamin Electric Mfg. Co., "Anti-Night."
Dale Co.
General Electric Co.
Hubbell, Harvey, "Hubbell."
**Brooks-Follis Electric Corpn.*
**Electric Appliance Co.*
**Holabird-Reynolds Electric Co.*
**Standard Electrical Works*
**Sterling Electric Co.*
**Western Electric Co.*

COILS

ARMATURE AND FIELD COILS

General Electric Co.
Western Electric Co., "Delta beston."
Westinghouse Elec. & Mfg. Co.

INDUCTION COILS

Electric Goods Mfg. Co.
Partrick, Carter & Wilkins Co.
Western Electric Co.
**Brooks-Follis Electric Corpn.*
**Electric Appliance Co,*
**Holabird-Reynolds Electric Co.*
**Standard Electrical Works.*
**Sterling Electric Co.*

SPARK COILS

American Electrical Works.
Electric Goods Mfg. Co.
Western Electric Co.
**Brooks-Follis Electric Corpn.*
**Electric Appliance Co.*
**Holabird-Reynolds Electric Co.*
**Standard Electrical Works*
**Sterling Electric Co.*

COMPOUNDS

BOILER COMPOUNDS

Dearborn Drug & Chemical Works.
Johns-Manville Co., H. W., "Magic."

CONDUIT

FLEXIBLE CONDUIT

American Circular Loom Co., "Circular Loom."
Cole Co., John R., "Circular Loom."
**Brooks-Follis Electric Corpn.*
**Electric Appliance Co,*
**Holabird-Reynolds Electric Co.*
**Standard Electrical Works*
**Sterling Electric Co.*
**Western Electric Co.*